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(54) TUBE CLOSURE

(71) We, BLENDAX - WERKE R. SCHNEIDER GMBH & Co., formerly known as Blendax-Werke R. Schneider & Co., organized according to the laws of Federal Republic of Germany, of 65 Mainz: Postfach 1580, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention concerns a tube closure made of elastic material which remains on the tube throughout the use of the tube until its contents has been completely consumed, and renders the screwing on and off of a tube cap which is necessary in the case of conventional tube closures, superfluous.

Tube closure of the type mentioned have been proposed for a long time and are described in numerous publications, for example German Gebrauchsmuster Nos. 1 723 472, 1 767 775, 1 959 472 and 7 009 863 and British Patent Specification No. 616,957.

Such closures, which normally consists of rubber or an elastic plastics material and are placed onto the external thread of a conventional squeeze-tube, have one or more slot-like incisions forming sealing lips, which should be closed in the relaxed state and be opened by pressure on the tube to release the tube content. When the pressure exerted on the tube is released, the sealing lips should close again automatically. Such a tube closure, therefore, should not only make screwing on and off of the hitherto necessary tube closure caps superfluous but also makes it possible to squeeze the tube with one hand.

The tubes closures of the above described type have proved to be impossible to apply in practice since the materials used for this purpose, on the one hand, either need too great an effort to press the tube, especially as a result of their hardness, to be able to allow a sufficient quantity of the tube contents to emerge, or on the other hand, are so soft that after successful discharge of the tube contents and relaxation of the pressure, the sealing lips no longer close completely so that the closure becomes unsound. In the latter case, difficulties are also encountered when filling the tube, particularly by means of the currently used standard automatic filling machines, because, owing to the relatively high pressure which occurs in the filling process, a part of the tube contents escapes through the sealing lips soon after filling.

It has now been discovered that a tube closure of the described kind, which does not have these disadvantages and has lips both possessing a good seal and resilience and opening easily when the tube is pressed to release the tube contents, is obtained if the tube closure is produced from an elastomeric material, with a Shore A-hardness lying in the range of 30 to 60, and preferably between 35 and 55.

Silicon rubber, cross-linked if desired, or nitrile rubber, i.e. copolymers of butadiene and acrylonitrile, and ethylene/ propylene copolymers have proved to be especially suitable elastomeric materials for the production of the tube closure according to the invention, but it is also possible to use other synthetic and natural elastomers, for example, acrylic acid ester copolymers, cross-linked if desired, fluororubber or even natural rubber, provided that the latter is not dissolved by the tube contents because this would cause the sealing lips to gum up.

These elastomeric materials can, as desired, be naturally coloured or dyed accordingly. There is a survey of suitable elastomers in the Pharmotechnischen Bericht v/70 of 20th December 1979, issued by Pharma Gummi Wimmer West GmbH, Eschweiler.

Securing the tube closure to the tube may be effected by means of a conventional tube thread. It is also possible, however to use tubes without threads and to flange on the tube closure or mould it onto the tubes or attach it in some similar manner.

In the case of tubes which have a so-called "threaded nipple' i.e. a projection consisting of plastics material mounted on the tube

neck and reaching into the tube opening, as are described, for example in the German Gebrauchsmuster Nos. 1 889 369 and 1 923 352, the tube closure according to the invention can be joined with this attachment to form one unit and as such may be fixed on the tube in a manner known *per se*.

As already indicated a satisfactory attachment of the tube closure to the tube can be achieved if the closure is joined to a one-part plastics member known *per se*, placed on the tube neck and covering the inner and outer wall of the latter, or is directly joined to the tube by locating it in an annular groove, which may replace the tube neck and be joined in one piece with the tube shoulder and the tube casing.

Tube attachments or insertions made of plastics material, to be applied to the tube neck, have been known for a long time and are described, for example in the German Gebrauchsmuster Nos. 1 889 369 and 1 923 352.

The invention will now be described in greater detail by way of Example with reference to the drawings. Figs. 1 to 7 of which are sections through various forms of tube closure in accordance with the invention.

Fig. 1 shows a tube (1) with a shoulder piece (2) and a tube neck-piece (3), onto which a tube atachment of known kind (4) made of plastics material is mounted. A tube closure (6), which has one or more pairs of sealing lips (7) obtained by slitting the end of the closure (6), is attached to the attachment (4) by means of a holding ring (5). If desired, a cap (8) can also be placed on this tube.

Fig. 2 shows a metal tube (1), (2), (3) provided with a tube attachment (4) made of plastics material, a so-called "threaded nipple". This tube attachment has an annular groove (9) at its upper end, into which the tube closure (6) is injection moulded.

It is also possible to prepare the tube closure and the tube attachment beforehand and then join them to form one unit. This joining can be achieved, for example, by gluing or by means of interlocking flanges. The combination of threaded nipple and lip closure can obviously also be prefabricated together with a screw cap as a unit and in the usual manner, be pressed onto the prefabricated metal tube, so that a trouble free organisation of the fully-automatic tube manufacture is possible.

A further embodiment of the invention consists, according to Fig. 3, in shaping the tube body (1, 2) at the tube shoulder (2) with an annular groove (10), instead of a tube neck. The tube closure is fixed in the groove (10) using a supporting sleeve (11), preferably with a fixing flange (12), and secured to the tube body (1 ,2) by flanging or turning over the lip of the groove (10). The supporting sleeve (11) may, if desired, be provided on its outer surface with a screw thread for receiving a screw-on cap, or provided with one or more circumferential corrugations (13) as a mount support for a press-on cap.

The attachment of the tube closure according to the invention to a tube provided with a thread, can also be effected in the manner described in German Gebrauchsmuster No. 7 230 168 by applying a ring over the outer circumference of the tube closure so as to distort the surface of the tube closure and cause it to conform to the threaded part of the tube; this ring prevents the closure from springing off during the filling process or during use. It has also been discovered that a satisfactory join of a tube of the conventional type to a tube closure according to the invention can be obtained by injection moulding the closure directly onto or into an annular groove surrounding the tube orifice.

This may be effected in the manner shown in Figs. 4 to 6.

Fig. 4 shows a longitudinal section through the upper part of a tube with tube casing (1), tube shoulder (2) and tube neck (3). An annular groove (14) is formed in the tube neck (3) and into this groove the part (15) of the tube closure (6) provided with one or more preferably radially extending slot-like incisions forming lips (7), is injection moulded.

To retain the part (15) more securely, it is of advantage to make the annular groove (14) taper towards the upper end of the tube orifice (14'), as shown in Fig. 5.

The manufacture of the tube according to Figs. 4 to 6 may be effected by mounting a ready-made tube body provided with an annular groove (14) on a mandrel, and then injection moulding the closure of elastomeric material using a moulding tool which has a cavity corresponding to the external shape of the closure. The front end of the mandrel which forms the inner cavity of the closure, is so formed that the inner contour of the closure member is shaped correspondingly.

In a subsequent operation the incisions and thus the formation of the sealing lips of the closure are formed by punching.

A further form of tube having a closure according to the invention may be seen in Fig. 6 in which the tube neck-piece (3) is frusto conical and is provided on its outside with a thread to receive an additional tube cap (8). Such a tube cap can alternatively be mounted by means of a simple press on closure.

Finally, the attachment of the tube closure according to the invention can also be carried out by providing the outside of the tube neck with saw-tooth-like grooves (16) (as

shown in Fig. 7), over which the closure is placed with the aid of a lubricant, preferably a lower alcohol such as ethyl-, n-propyl- or isopropyl-alcohol.

It is also possible before filling the tube, to mount a cover cap, preferably made of transparent plastics material, over the tube closure, which cap is removed before using the filled tube for the first time, and can be provided with a pull-off flap for easier handling.

The tube closure according to the invention may be used for any filling material normally packed in tubes.

Examples of suitable filling materials are in particular cosmetics, such as tooth-paste, skin cream, shaving cream, and food and food supplements such as mustard, mayonnaise, or preserves.

WHAT WE CLAIM IS:—

1. A tube closure consisting of an elastomeric material and having one or more slot-like incisions, which open when pressure is applied to the tube to release the tube content, and are securely closed when no pressure is applied, wherein the elastomeric material has a Shore A-hardness of 30 to 60.

2. A tube closure as claimed in claim 1, wherein the elastomeric material has a Shore A-hardness of 35 to 55.

3. A tube closure as claimed in claim 1 or claim 2, wherein the slot-like incisions extend radially of the tube closure.

4. A tube closure as claimed in any one of claims 1 to 3, wherein the elastomeric material is a silicon rubber, which may be cross-linked.

5. A tube closure as claimed in any one of claims 1 to 3, wherein the elastomeric material is a nitrile rubber, which may be cross-linked.

6. A tube closure as claimed in any one of claims 1 to 3, wherein the elastomeric material is an ethylene/propylene copolymer.

7. A tube having a tube closure as claimed in any one of claims 1 to 6.

8. A tube as claimed in claim 7 wherein the tube closure is flanged onto a neck portion of the tube.

9. A tube as claimed in claim 7, wherein the tube closure is secured on the tube by means of a one-part plastics member mounted on the tube neck and covering the inner and outer wall of the tube neck.

10. A tube as claimed in claim 9, wherein the tube closure is secured on the plastics member placed on the tube neck by means of a holding ring.

11. A tube as claimed in claim 9, wherein the tube closure is secured on the tube by injection moulding it into an annular groove disposed at one end of the plastics member.

12. A tube as claimed in claim 7, wherein the tube does not have a neck and the tube closure is secured in an annular groove in the shoulder of the tube.

13. A tube as claimed in claim 12, wherein the tube closure is secured in the annular groove by means of a supporting sleeve which is anchored in the annular groove by means of a flange.

14. A tube as claimed in claim 7, wherein the tube closure is secured on the tube by injection moulding it into an annular groove located at the end of the tube neck.

15. A tube as claimed in claim 14, wherein the annular groove is tapered towards the end of the tube neck.

16. A tube as claimed in claim 7, wherein the tube closure is secured to the tube neck by means of a plurality of saw tooth grooves.

17. A process for the manufacture of a tube as claimed in claim 7 wherein a tube closure as claimed in claim 1 is secured to a tube.

18. A process as claimed in claim 17, wherein the tube body is mounted on a mandrel, and the closure of elastomeric material is injection moulded onto the tube, into an annular groove at the end of the tube neck, the internal shape of the closure facing the tube opening being formed by the end of the mandrel, and subsequently the slot-like incisions are made in the surface of the tube closure.

19. A process as claimed in claim 17, conducted substantially as described herein with reference to any one of Figures 1 to 7 of the accompanying drawings.

20. A tube closure as claimed in claim 1, substantially as described herein with reference to and as shown in any one of Figures 1 to 7 of the accompanying drawings.

21. A tube as claimed in claim 7, substantially as described herein with reference to and as shown in any one of Figures 1 to 7 of the accompanying drawing.

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1474620 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

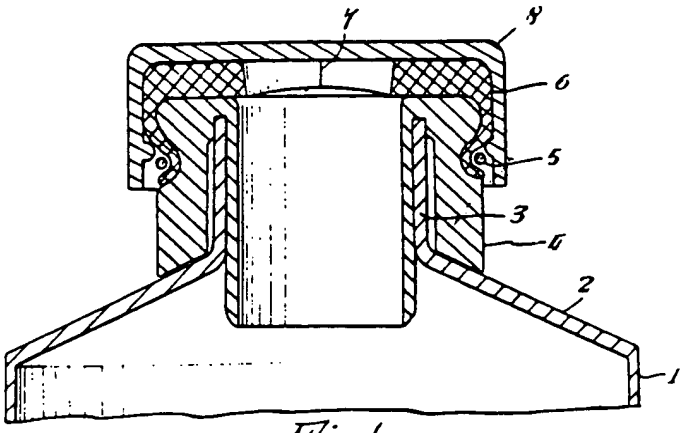

Fig.1.

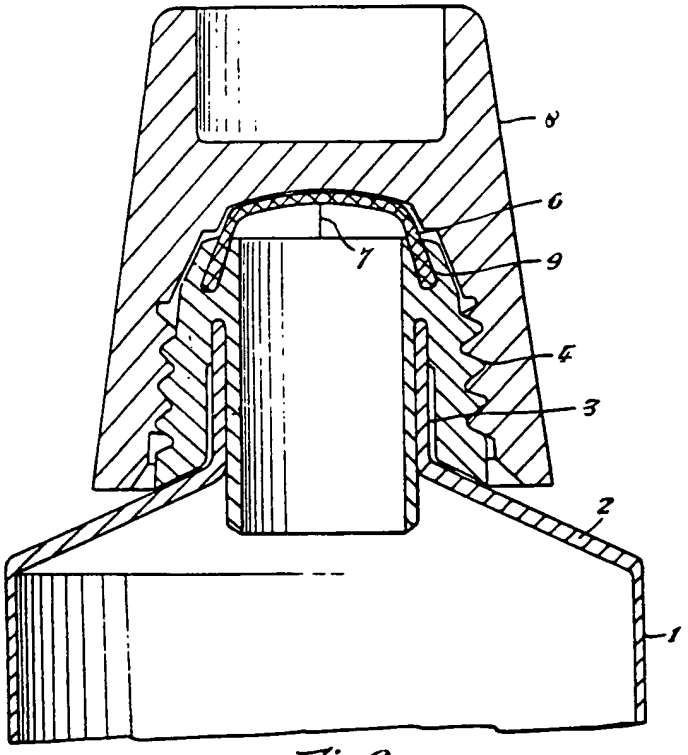

Fig.2.

1474620 COMPLETE SPECIFICATION

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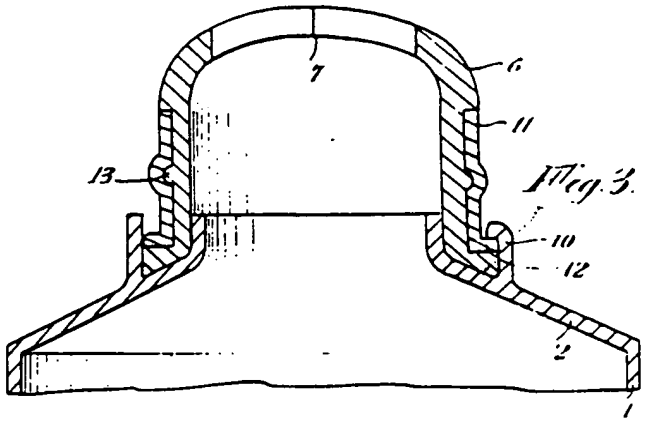

Fig. 3.

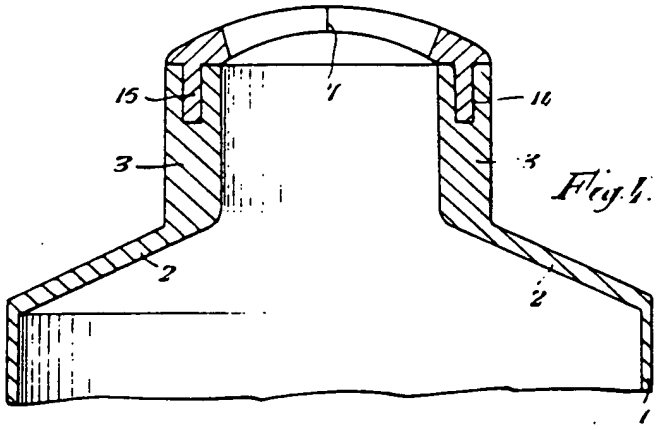

Fig. 4.

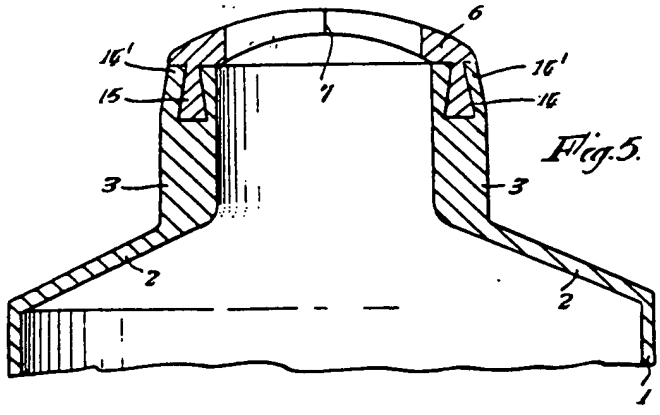

Fig. 5.

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Sheet 3

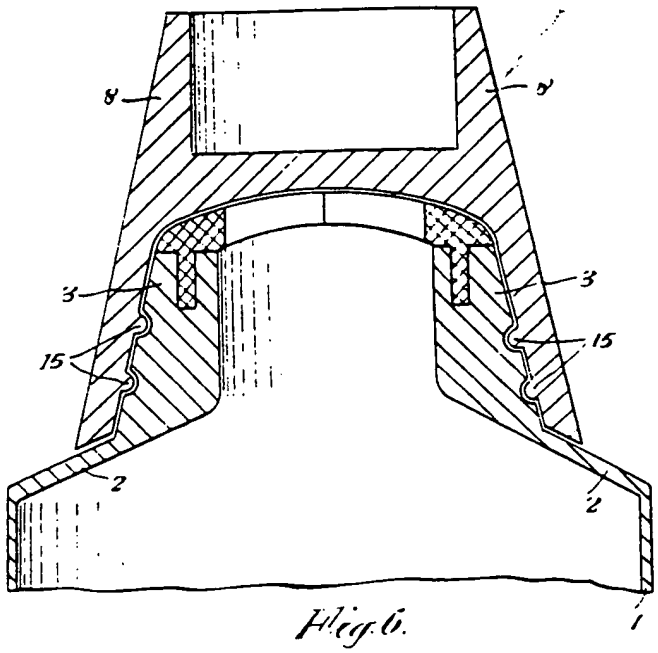

Fig. 6.

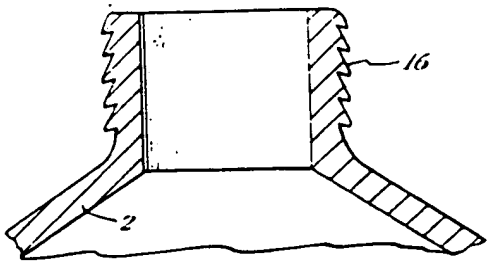

Fig. 7.